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THE SEASONS, CAUSES, AND GEOGRAPHICAL DISTRIBUTION OF HAY FEVER AND HAY-FEVER RESORTS IN THE UNITED STATES.

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As hay fever is due to the inhalation of wind-borne pollens, the fecundating element of many plants varying in their geographical distribution and period of bloom, the seasons of hay fever, and its character, differ greatly in the various States of the Union.

Hay fever, in different individuals, varies not only in degree, but also in the character of the sensitization.[1] There are, for instance, subjects who are sensitive to the pollen of the ragweed, *Ambrosia*, and not to that of the grasses, and vice versa; others who react to the pollen of the wormwoods, species of *Artemisia*, but not to that of the grasses or ragweeds. Others again who react, in various degrees, to all of these pollens.

As a result of this the type of hay fever varies in different sections of the United States according to the distribution of the plants that cause the disease. For a similar reason the hay-fever seasons vary in different sections, being dependent upon the flowering season of these plants.

Classification.

Although hay fever is due to the pollen of hundreds of different (anemophilous) plants, our investigations have shown that biologically most of these may be divided into four groups, viz, Poaceæ, Ambrosiaceæ, *Artemisia*, and Chenopodiaceæ, any member or a combination of several of which may be used for immunizing purposes.[2]

A patient sensitive to the pollen protein of one of the several thousands of grasses, Poaceæ, for instance, is sensitive in various degrees to the others. This is an important matter, as the grass pollens are the principal cause of spring hay fever in most sections of the United States, and this biological similarity renders the immunizing treatment practicable.

The other most common cause of hay fever is the ragweed, and we have found that the pollen of the common ragweed, *Ambrosia elatior*,

[1] Hay Fever and Hay-Fever Pollens. W. Scheppegrell, M. D., Archives of Internal Medicine, June, 1917

[2] Classification of Hay-Fever Pollens from a Biological Standpoint. W. Scheppegrell, M. D., Boston Medical and Surgical Journal, July, 1917.

a representative not only of all the ragweeds, but also of the marsh-elders, *Iva*, bur ragweed, *Franseria*, and cockleburs, *Xanthium*, so that the pollen extract of *A. elatior* may be used for immunizing purposes for this group, Ambrosiaceæ.[1]

In addition to these, we have segregated, from a biological standpoint, the *Artemisia* group, representing over 30 species of wormwoods, and the Chenopodiaceæ group, including true chenopods, *Chenopodium;* amaranths, *Amaranthus;* Russian thistle, *Salsola pestifer* and *kali;* and the docks, *Rumex crispus, acetosella*, etc. The names of the representative groups are therefore given for each State.

In addition to stating the groups that cause hay fever in the different States, the names of the most common plants are given. While a pollen extract representative of the group may be used in most cases, one prepared from the pollen of the plants directly responsible sometimes gives more satisfactory results and should be used when available. The ragweed, for instance, is also representative of the bush sandbur and bur ragweeds, *Franseria dumosa* and *acanthicarpa*, but when these are in excess of the ragweeds, *Ambrosia*, as they are in the Dakotas, Nebraska, Wyoming, New Mexico, and Arizona, it is advantageous to use the pollen of the species of *Franseria.*

The Cereals in Hay Fever.

The cereals, such as wheat, rye, oats, and corn, also have hay-fever pollens and should be added as a local cause of hay fever in most of the States. The pollen of corn, however, is so large (80 microns) that its potential area is very circumscribed.

The cereals are included in the Poaceæ group.

Hay-Fever Seasons.

In the following report the hay-fever seasons of both spring and fall hay fever for all the States are given. These are based on the reports of experienced rhinologists in each State. These seasons vary somewhat with different years (as they are influenced by weather conditions), and the dates given are the average for several years.

The hay-fever seasons of the subjects also vary, being influenced by the individual degree of sensitization. When this is high, the patient's attack commences as soon as there is in the air a small percentage of the pollen to which he reacts, while a less sensitive patient's attack commences only when the pollen infestation is high, which may be a week or more later. The same principle applies to the ending of the season.

[1] The Treatment of Hay Fever. W. Scheppegrell, M. D., Public Health Reports, Aug. 1, 1919.

Hay-Fever Resorts.

There are few localities in the United States absolutely free from hay fever, as the pollen of most of hay-fever plants is very buoyant and will traverse 5 or 6 miles under favorable wind conditions. Those localities in the list reported, however, are relatively free, and will therefore be found useful in determining the nearest locality in which the patient may find relief.

ALABAMA.[1]

Spring hay fever.—April 15 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being the following: Johnson grass, *Holcus halepensis;* crabgrass, *Syntherisma sanguinalis;* yellow foxtail, *Chætochloa lutescens;* barnyard grass, *Echinochloa crus-galli;* goose grass, *Eleusine indica;* water grass, *Paspalum dilatatum;* and Bermuda grass, *Capriola dactylon.*

Minor cause: Curly dock, *Rumex crispus,* and spiny amaranth, *Amaranthus spinosus*—Chenopodiaceæ group.

Locally: Elms, *Ulmus americana* and *alata;* cottonwood, *Populus deltoides,* and oaks, species of *Quercus.*

Fall hay fever.—August 18 to October 10.

Principal cause: Common ragweed, *Ambrosia elatior;* the giant ragweed, *Ambrosia trifida.* Rough marsh-elder, *Iva ciliata,* and cocklebur, species of *Xanthium,* are less frequent causes. All belong to the Ambrosiaceæ group.

Hay-fever resorts.—The towns along Mobile Bay are resorts for people having asthma. The Sand Mountain region of the State, comprising the counties of Etowah, Marshall, Cherokee, Blount, Morgan, Colbert, and Marion, and also Talladega, Shelby, Clay, and Randolph, are comparatively free of asthmatics.

ARIZONA.

Spring hay fever.—May 5 to June 5.

Principal cause: The grasses, the most common being the following: Annual fescue, *Festuca octoflora;* six-weeks grama, *Bouteloua aristidoides;* mesa grass, *Bouteloua rothrockii;* annual poverty grass, *Aristida bromoides;* blue grama, *Bouteloua gracilis;* silvertop, *Andropogon saccharoides*—Poaceæ group.

Locally: Cottonwood, *Populus macdougali,* and Arizona ash, *Fraxinus attenuata.*

Fall hay fever.—July 15 to October 1.

Principal cause: The species of *Franseria,* some of which resemble the ragweeds and some the cockleburs. The most common are *Fran-*

[1] The author hereby expresses his appreciation of the United States Department of Agriculture and of the members of the Botanical Department of the American Hay-Fever Prevention Association for valuable assistance in preparing this report.

seria discolor, deltoides, dumosa (bush sandbur), *eriocentra, ambrosioides, ilicifolia,* and *cordifolia.*

The ragweeds, *Ambrosia,* are also found, although much less common, the species being *Ambrosia aptera* and *psilostachya.* The species of *Franseria* and the ragweeds both belong to the Ambrosiaceæ group.

The wormwoods are also a common cause of hay fever, the most common being prairie sage, *Artemisia gnaphalodes,* found at altitudes of from 3,500 to 6,000 feet; 'Indian wormwood,' *A. dracunculoides; A. filifolia,* in the southeastern part of the State; and sagebrush, *A. tridentata,* in the northern part—*Artemisia* group.

Hay-fever resorts.—The State board of health reports that there are no hay-fever resorts in Arizona.

ARKANSAS.

Spring hay fever.—June 10 to July 15.

Principal cause: The grasses, Poaceæ group, the following being the most common: Redtop, *Agrostis palustris;* yellow foxtail, *Chætochloa lutescens;* witch grass, *Panicum capillare;* crabgrass, *Syntherisma sanguinalis;* broom sedge, *Andropogon virginicus,* and blue grass, *Poa pratensis.*

Minor cause: Jerusalem oak and lamb's-quarters, *Chenopodium botrys* and *album*—Chenopodiaceæ group.

Locally: Red maple, *Acer rubrum;* swamp poplar, *Populus heterophylla,* and black willow, *Salix nigra.*

Fall hay fever.—August 10 to September 17.

Principal cause: Common ragweed, *Ambrosia elatior,* and the lance-leaf ragweed, *Ambrosia bidentata.* The giant ragweed, *Ambrosia trifida,* is common in moist localities. All these belong to Ambrosiaceæ group. The tall wormwood, *Artemisia caudata,* is prevalent in dry, stony places—*Artemisia* group.

Minor cause: Cockleburs, *Xanthium* species—Ambrosiaceæ group.

Hay-fever resorts.—Eureka Springs, Heber Springs, Sylvan Springs, and Winslow, all located in the Ozark Range.

CALIFORNIA.

Spring hay fever.—May 5 to July 5.

Principal cause: The grasses, the most common being rye grass, *Lolium perenne;* saltgrass, *Distichlis spicata;* Bermuda grass, *Cynodon dactylon;* broncho grass, *Bromus maximus;* wild oats, *Avena fatua;* and Johnson grass, *Holcus halepensis.*

Minor cause: Greasebush, *Hymenoclea salsola; Rumex conglomeratus;* sheep-sorrel, *Rumex acetosella;* lamb's-quarters or goosefoot, *Chenopodium album;* tumbleweed, *Amaranthus graecizans,* and saltbushes, species of *Atriplex*—Chenopodiacæ group.

Fall hay fever.—July 15 to September 10.

Principal cause: Sagebrush, *Artemisia tridentata,* mugwort, *Artemisia heterophylla—Artemisia* group.

Minor cause: Poverty weed, *Iva axillaris;* bush sandbur, *Franseria dumosa;* western ragweed, *Ambrosia psilostachya,* and (less common) cocklebur, *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—Santa Cruz, Del Monte, Santa Barbara, and Coronado along the coast, and Lake Tahoe and other places among the high Sierras.

COLORADO.

Spring hay fever.—May 10 to July 5.

Principal cause: The grasses, Poaceæ group, the most common being short-awned chess, *Bromus brizæformis;* downy brome grass, *Bromus tectorum;* Colorado bluestem, *Agropyron smithii;* bluegrass, *Poa pratensis;* orchard grass, *Dactylis glomerata;* prairie June grass, *Koeleria cristata;* blue grama, *Bouteloua gracilis;* silk grass, *Agrostis hiemalis;* timothy, *Phleum pratense;* and squirrel-tail, *Hordeum jubatum.*

Minor cause: Chenopods and their allies, species of *Chenopodium,* and the Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Locally: The cottonwoods, *Populus sargentii* and *angustifolia;* oaks, *Quercus* (in southern half of the State), and boxelder, *Acer negundo* (in the canyons).

Fall hay fever.—July 20 to September 15.

Principal cause: Sagebrush, *Artemisia tridentata,* which covers vast areas almost to the exclusion of other plants. Other sages are collectively common—*Artemisia* group. Also, the common ragweed, *Ambrosia elatior,* and prairie ragweed, *Iva xanthiifolia,* both of which are common roadside weeds—Ambrosiaceæ group.

Hay-fever resorts.—Silver Plume, and other mountains having an altitude of over 7,000 feet.

CONNECTICUT.

Spring hay fever.—June 1 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being witch grass, species of *Panicum;* little bluestem, *Andropogon scoparius;* yellow foxtail, *Chætochloa lutescens;* barnyard grass, *Echinochloa crus-galli;* crabgrass, *Syntherisma serotina;* bluegrass, *Poa pratensis;* and beard grass, *Paspalum setaceum.*

Locally: Cottonwood, *Populus deltoides;* black walnut, *Juglans nigra;* and the oaks, species of *Quercus.*

Fall hay fever.—August 17 to October 1.

Principal cause: The common ragweed, *Ambrosia elatior*—Ambrosiaceæ group.

Minor cause: The cockleburs, species of *Xanthium;* marsh-elder, *Iva frutescens*—Ambrosiaceæ group.

Hay-fever resorts.—The Litchfield Hills, in the northwestern part of the State, afford relief in a certain class of cases along the coast; and the seaside resorts, especially in the New London district, afford relief to a class of inland cases.

DELAWARE.

Spring hay fever.—May 5 to July 10.

Principal cause: The grasses, Poaceæ group, the most common being timothy, *Phleum pratense;* wheat, *Triticum æstivum;* yellow foxtail, *Chætochloa lutescens;* broom sedge, *Andropogon virginicus;* little crabgrass, *Syntherisma serotina;* bluegrass, *Poa pratensis;* orchard grass, *Dactylis glomerata.*

Minor cause: Sheep-sorrel, *Rumex acetosella;* goosefoot, species of *Chenopodium*—Chenopodiaceæ group.

Locally: Elm, *Ulmus americana;* black willow, *Salix nigra;* and red maple, *Acer rubrum.*

Fall hay fever.—August 13 to September 20.

Principal cause: The common ragweed, *Ambrosia elatior*—Ambrosiaceæ group.

Minor cause: Giant ragweed, *Ambrosia trifida,* and the cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

DISTRICT OF COLUMBIA.

Spring hay fever.—May 20 to July 5.

Principal cause: The grasses, Poaceæ group, the most common being timothy, *Phleum pratense;* bluegrass, *Poa pratensis;* redtop, *Agrostis palustris;* orchard grass, *Dactylis glomerata;* brome sedge, *Andropogon virginicus;* crabgrass, *Syntherisma sanguinalis;* spreading witch grass, *Panicum dichotomiflorum;* chess, *Bromus secalinus.*

Minor cause: The docks, *Rumex crispus* and *obtusifolius*—Chenopodiaceæ group.

Locally: The cottonwood, *Populus deltoides,* and the oaks, *Quercus rubra, phellos,* and *alba.*

Fall hay fever.—August 17 to October 3.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group, the former being common in alleys, vacant lots, and roadsides generally. Occasionally also the wormwoods, *Artemisia caudata, annua,* and *vulgaris*—Artemisia group.

FLORIDA.

Spring hay fever.—May 1 to July 10.

Principal cause: The grasses, Poaceæ group, the following being the most common: Crabgrass, *Syntherisma sanguinalis;* Johnson grass, *Holcus halepensis;* yellow foxtail, *Chætochloa lutescens;* feather-

grass, *Leptochloa filiformis;* water grass, *Paspalum dilatatum;* marsh grass, *Panicum repens;* and barnyard grass, *Echinochloa crus-galli.*

Minor cause: Spiny amaranth *Amaranthus spinosus;* curly dock, *Rumex crispus;* wormseed, *Chenopodium ambrosioides*—Chenopodiaceæ group.

Locally: Black willow, *Salix nigra,* elm, *Ulmus americana;* cottonwood, *Populus deltoides;* and oaks, species of *Quercus.*

Fall hay fever.—August 18 to October 10.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group.

Minor cause: Marsh-elder, *Iva ciliata;* and cockleburs, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—The coast of southern Florida affords partial relief.

GEORGIA.

Spring hay fever.—May 10 to July 5.

Principal cause: The grasses, Poaceæ group, the most common being Bermuda grass, *Capriola dactylon;* Johnson grass, *Holcus halepensis;* wild barley, *Hordeum pusillum;* annual fescue, *Festuca octoflora;* crabgrass, *Syntherisma sanguinalis;* yellow foxtail, *Chætochloa lutescens;* goose grass, *Elusine indica.*

Locally: Swamp poplar, *Populus heterophylla;* black willow, *Salix nigra;* red maple, *Acer rubrum;* and oaks, species of *Quercus.*

Fall hay fever.—August 18 to October 4.

Principal cause: The common and giant ragweeds, *Ambrosia elatior* and *trifida,* the latter being more common on bottom lands—Ambrosiaceæ group.

Minor cause: Marsh-elder, *Iva ciliata,* and cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—Brasstown, Bald Mountain.

IDAHO.

Spring hay fever.—May 5 to June 10.

Principal cause: The grasses, Poaceæ group, the most common being Hungarian brome grass, *Bromus inermis;* feather bunchgrass, *Stipa viridula;* dogtown grass, *Aristida longiseta;* sleepy grass, *Stipa vaseyi;* false oat grass, *Trisetum spicatum;* Colorado bluestem grass, *Agropyron smithii;* bearded wheat grass, *Agropyron caninum,* and other tall wheat grasses.

Fall hay fever.—August 1 to September 15.

Principal cause: Sagebrush, *Artemisia tridentata;* Indian wormwood, *Artemisia dracunculoides—Artemisia* group. Poverty weed, and prairie ragweed, *Iva axillaris* and *xanthiifolia*—Ambrosiaceæ group.

Minor cause: Bur ragweed, *Franseria acanthicarpa;* giant and western ragweed, *Ambrosia trifida* and *psilostachya*—Ambrosiaceæ group. Greasewood, *Sarcobatus vermiculatus;* Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—None reported.

ILLINOIS.

Spring hay fever.—June 10 to July 20.

Principal cause: The grasses, the most common being yellow foxtail, *Chætochloa lutescens;* crabgrass, *Syntherisma sanguinalis;* witch grass, *Panicum capillare;* squirrel-tail, *Hordeum jubatum;* and love grass, *Eragrostis cilianensis;* also the cereals—Poaceæ group.

Minor cause: The amaranths, *Amaranthus retroflexus* and *graecizans;* sheep-sorrel and curly dock, *Rumex acetosella* and *crispus;* lamb's-quarters, *Chenopodium album,* and saltwort, *Salsola kali*—Chenopodiaceæ group.

Locally: Elm, *Ulmus americana,* black willow, *Salix nigra,* and oaks, species of *Quercus.*

Fall hay fever.—August 15 to September 20.

Principal cause: Common ragweed, *Ambrosia elatior,* cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Minor cause: Giant ragweed, *Ambrosia trifida.*

Hay-fever resorts.—The State board of health reports no location free from hay fever.

INDIANA.

Spring hay fever.—June 5 to July 15.

Principal cause: The grasses, Poaceæ group, the following being the most common: Bluegrass, *Poa pratensis;* timothy, *Phleum pratense;* foxtail, species of *Chætochloa;* crabgrass, *Syntherisma sanguinalis;* witch grass, *Panicum capillare;* stinking grass, species of *Eragrostis;* downy brome grass, *Bromus tectorum;* broom sedge, species of *Andropogon.*

Locally: Elm, *Ulmus americana;* black willow, *Salix nigra;* swamp poplar, *Populus heterophylla;* and oaks, species of *Quercus.*

Fall hay fever.—August 17 to September 25.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group. The latter is especially common on railroad embankments, and grows to a height of 12 to 15 feet along the sandy river bottoms. The green wormwood, *Artemisia biennis,* is also fairly common—*Artemisia* group.

Minor cause: Russian thistle, *Salsola pestifer,* and Jerusalem oak, *Chenopodium botrys*—Chenopodiaceæ group; poverty weed, *Iva axillaris*—Ambrosiaceæ group.

Hay-fever resorts.—The State board of health reports that no section is free from hay fever, and hay-fever sufferers wishing to secure relief go to northern Michigan.

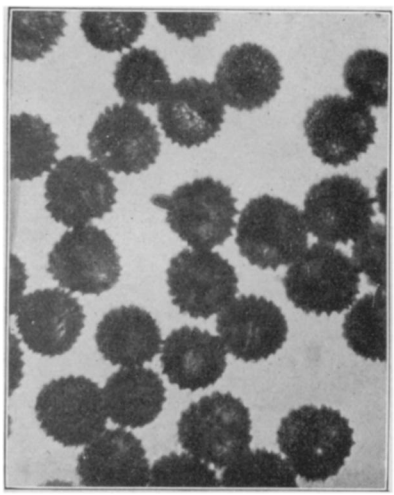

Fig. 1.—Pollen of common ragweed (Ambrosia elatior) ×500 diameters; the principal cause of fall hay fever in the United States.

Fig. 2.—Pollen of water grass (Paspalum larranagai) ×500 diameters. The grasses are the principal cause of spring hay fever, erroneously called "rose cold."

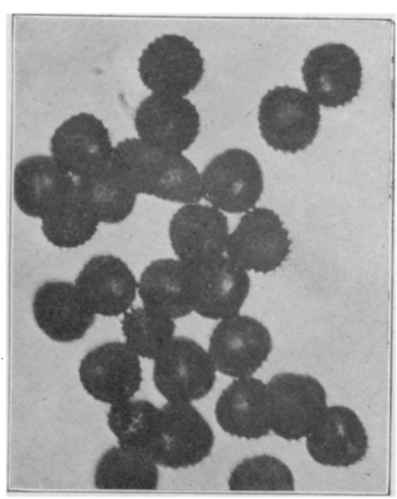

Fig. 3.—Pollen of bur ragweed (Franseria tenuifolia) ×500 diameters. The Franserias replace the common ragweed in California, Arizona, and the neighboring States.

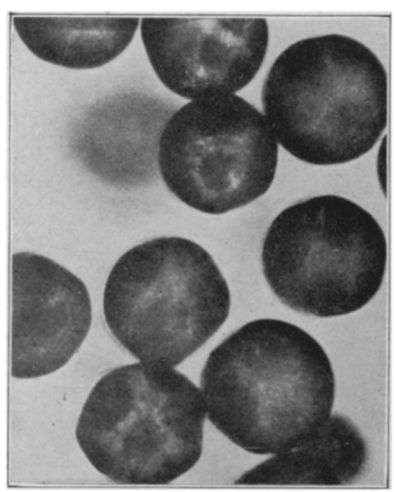

Fig. 4.—Pollen of red maple (Acer rubrum) ×500 diameters. A local cause of early hay fever.

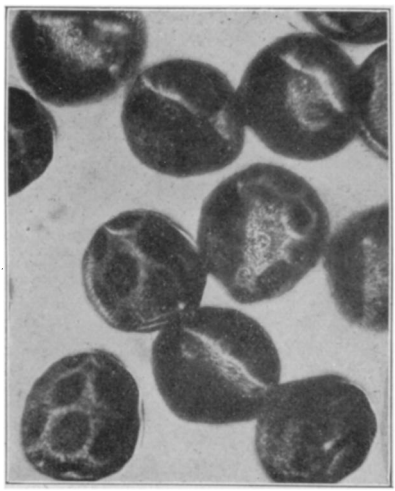

Fig. 5.—Pollen of black walnut (Juglans nigra) ×500 diameters; a cause of early hay fever in some sections.

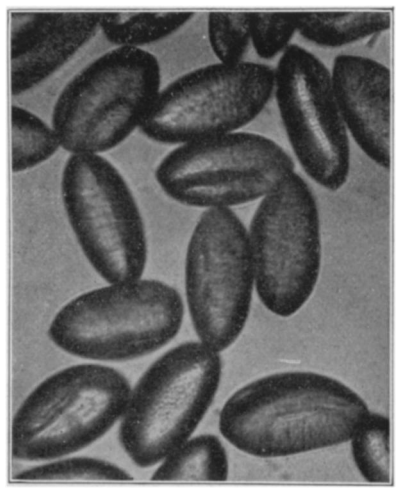

Fig. 6.—Pollen of live oak (Quercus virens) ×500 diameters; a local cause of hay fever. The appearance of this pollen is characteristic of many tree pollens.

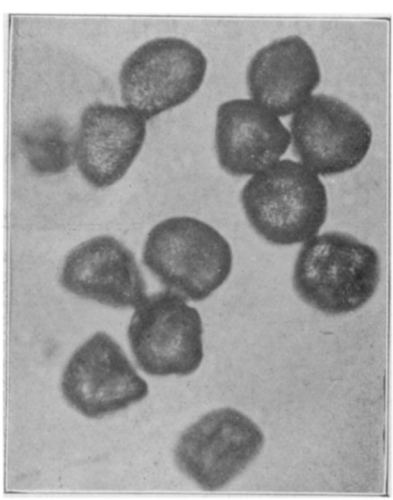

Fig. 7.—Pollen of bulrush (Scirpus lacustris) ×500 diameters; harmless in hay fever.

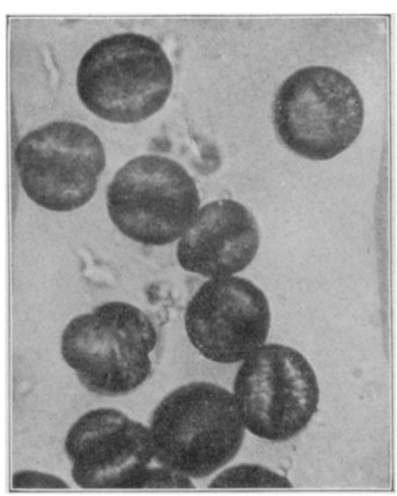

Fig. 8.—Pollen of mugwort (Artemisia heterophylla) ×500 diameters. The Artemisias (wormwoods) are the principal cause of hay fever in the Pacific and Rocky Mountain States.

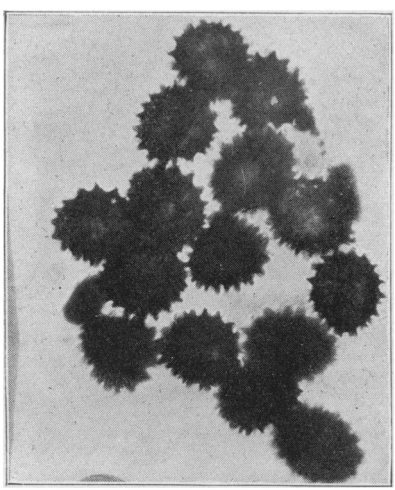

Fig. 9.—Pollen of goldenrod (Solidago canadensis) ×500 diameters. In spite of the popular belief to the contrary, the goldenrod is insect-pollinated and, therefore, not a cause of hay fever.

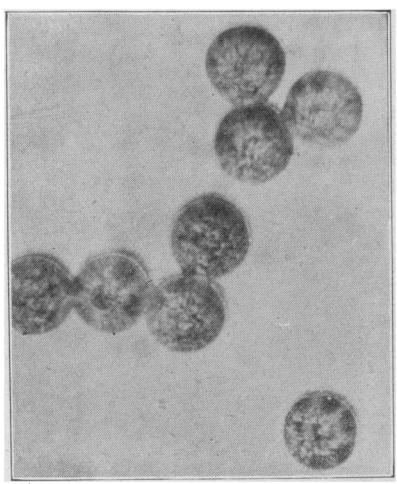

Fig. 10.—Pollen of spiny amaranth (Amaranthus spinosus) ×500 diameters. The Amaranthus and the docks are a minor cause of hay fever in most sections of the United States

IOWA.

Spring hay fever.—June 2 to July 16.

Principal cause: The grasses, Poaceæ group, the most common being spreading witch grass, *Panicum dichotomiflorum;* barnyard grass, *Echinochloa crus-galli;* crabgrass, *Syntherisma sanguinalis;* broom sedges, *Andropogon scoparius* and *furcatus;* timothy, *Phleum pratense;* bluegrass, *Poa pratensis,* and squirrel-tail, *Hordeum jubatum.*

Minor cause: Lamb's-quarters, *Chenopodium album,* and Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Local cause: White ash, *Fraximus americana;* winged elm, *Ulmus alata,* and oaks, *Quercus macrocarpa, rubra,* and *alba.*

Fall hay fever.—August 13 to September 27.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida;* the western ragweed, *Ambrosia psilostachya,* and prairie ragweed, *Iva xanthiifolia* being an occasional cause—Ambrosiaceæ group. The wormwoods, *Artemisia ludoviciana, canadensis, biennis, serrata,* and *caudata—Artemisia* group.

Hay-fever resorts.—The State board of health reports none known in the State.

KANSAS.

Spring hay fever.—May 16 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Bluegrass, *Poa pratensis;* brome grass, *Bromus* species; yellow foxtail, *Chætochloa lutescens;* timothy, *Phleum pratense;* squirrel tail, *Hordeum jubatum;* quack grass, *Agropyron repens;* and wild rye, *Elymus glabriflorus.*

Locally: Cottonwood, *Populus sargentii;* black willow, *Salix nigra;* and red maple, *Acer rubrum.*

Fall hay fever.—August 16 to September 28.

Principal cause: The common, giant, and western ragweed, *Ambrosia elatior, trifida,* and *psilostachya*—Ambrosiaceæ group.

Minor cause: Saltweed, *Atriplex argentea* and *hastata*—Chenopodiaceæ group, and cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

KENTUCKY.

Spring hay fever.—June 1 to July 18.

Principal cause: The grasses, the most common being bluegrass, *Poa pratensis;* redtop, *Agrostis palustris;* timothy, *Phleum pratense;* crabgrass, *Syntherisma sanguinalis;* and yellow foxtail, *Chætochloa lutescens*—Poaceæ group.

Minor causes: Curly and bitter dock, and sheep-sorrel, *Rumex crispus, obtusifolius,* and *acetosella;* spiny amaranth, *Amaranthus*

spinosus and *retroflexus;* lamb's-quarters and wormseed, *Chenopodium album* and *ambrosioides*—Chenopodiaceæ group.

Locally: Aspen, *Populus tremuloides;* black walnut, *Juglans nigra;* and the oaks, species of *Quercus.*

Fall hay fever.—August 15 to October 1.

Principal cause: Common ragweed, *Ambrosia elatior,* the giant ragweed, *Ambrosia trifida,* being common on low ground, and the lance-leaf ragweed, *Ambrosia bidentata,* being found in western Kentucky—Ambrosiaceæ group. The annual wormwood, *Artemisia annua,* is common on low ground and vacant lots about the outskirts of cities—*Artemisia* group.

Hay-fever resorts.—None reported.

LOUISIANA.

Spring hay fever.—May 7 to July 15.

Principal cause: The grasses, the most common being the following: Johnson grass, *Holcus halepensis;* Bermuda grass, *Capriola dactylon;* yellow foxtail, *Chætochloa lutescens;* feather grass, *Leptochloa filiformis;* marsh grass, *Panicum repens;* annual bluegrass, *Poa annua;* water grass, *Paspalum dilatatum* and *larranagai;* and smut grass, *Sporobolus berteroanus*—Poaceæ group.

Minor cause: Curley dock, *Rumex crispus;* spiny amaranth, *Amaranthus spinosus;* lamb's-quarters, *Chenopodium album*—Chenopodiaceæ group.

Locally: The oaks, *Quercus palustris, rubra,* and *virginiana;* swamp poplar, *Populus heterophylla,* and black willow, *Salix nigra.*

Fall hay fever.—August 10 to October 16.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida,* the latter being common near the Gulf coast.

Minor cause: Marsh-elder, *Iva ciliata,* and the cocklebur, species of *Xanthium.* All belong to the Ambrosiaceæ group.

Hay-fever resorts.—Covington, Abita Springs, and Magnolia afford relief in the spring type of hay fever.

MAINE.

Spring hay fever.—June 5 to July 10.

Principal cause: The grasses, the most common being quack grass, *Agropyron repens;* barnyard grass, *Echinochloa crus-galli;* redtop, *Agrostis palustris;* fescue grass, *Festuca elatior;* timothy, *Phleum pratense;* and bluegrass, *Poa pratensis*—Poaceæ group.

Minor cause: The docks, *Rumex crispus* and *obtusifolius;* pigweed, *Amaranthus retroflexus;* and lamb's quarters, *Chenopodium album*—Chenopodiaceæ group.

Locally: The aspens, *Populus grandidentata, tremuloides,* etc., and the oaks, *Quercus rubra* and *alba.*

Fall hay fever.—August 17 to September 24.

Principal cause: The common ragweed, *Ambrosia elatior*—Ambrosiaceæ group.

Minor cause: The wormwoods, *Artemisia caudata* and *stelleriana*, being common on the sand of Old Orchard, Scarborough, and Cape Elizabeth. *Artemisia biennis* is also becoming more common—*Artemisia* group.

Hay-fever resorts.—Rangeley Lakes, and Kineo, located on Moosehead Lake.

MARYLAND.

Spring hay fever.—May 15 to July 10.

Principal cause: The grasses, the following being the most common: Timothy, *Phleum pratense;* wheat; slough grasses, *Spartina;* wild rice, *Zizania palustris;* broom sedge, *Andropogon virginicus;* green foxtail, *Chætochloa viridis;* bluegrass, *Poa pratensis;* quack grass, *Agropyron repens;* and oats—Poaceæ group.

Minor cause: The curly and bitter docks, and sheep-sorrel, *Rumex crispus, obtusifolius,* and *acetosella;* pigweed, *Amaranthus retroflexus;* and lamb's quarters and wormseed, *Chenopodium album* and *ambrosioides*—Chenopodiaceæ group.

Fall hay fever.—May 15 to July 10.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida.*

Minor cause: Marsh-elder, *Iva frutescens,* and cockleburs, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

MASSACHUSETTS.

Spring hay fever.—June 5 to July 18.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Witch grass, *Panicum capillare;* little bluestem, *Andropogon scoparium;* green foxtail, *Chætochloa viridis;* quack grass, *Agropyron repens;* orchard grass, *Dactylis glomerata;* barnyard grass, *Echinochloa crus-galli;* and annual bluegrass, *Poa annua.*

Minor cause: Pigweed, *Amaranthus hybridus,* and Jerusalem oak, *Chenopodium botrys*—Chenopodiaceæ group.

Locally: Black willow, *Salix nigra;* aspen, *Populus tremuloides;* and oaks, species of *Quercus.*

Fall hay fever.—August 13 to September 25.

Principal cause: Common ragweed, *Ambrosia elatior*—Ambrosiaceæ group.

Minor cause: Russian thistle, *Salsola pestifer*—Chenopodiaceæ group, and cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—Commissioner of public health reports no known hay-fever resort.

MICHIGAN.

Spring hay fever.—June 8 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Bull grass, *Tripsacum dactyloides;* broom beard-grass, *Schizachyrium scoparium;* forked beard-grass, *Andropogon furcatus;* Indian grass, *Sorghastrum nutans;* prairie grass, *Sporobolus cryptandrus;* Canada blue grass, *Poa compressa;* barnyard grass, *Echinochloa crus-galli;* witch grass, *Panicum capillare.*

Minor cause: Water-hemp, *Acnida tamariscina;* pigweed, *Amaranthus retroflexus;* and lamb's-quarters, *Chenopodium album*—Chenopodiaceæ group.

Locally: Aspens, *Populus grandidentata* and *tremuloides;* white elm, *Ulmus americana;* red maple, *Acer rubrum;* and oaks, *Quercus rubra, alba,* and *coccinea.*

Fall hay fever.—August 15 to September 25.

Principal cause: Common ragweed, *Ambrosia elatior.*

Minor cause: Cocklebur, species of *Xanthium*—Ambrosiaceæ group; and green wormwood, *Artemisia biennis—Artemisia* group.

Hay-fever resorts.—The northern part of Michigan is relatively free from hay fever.

MINNESOTA.

Spring hay fever.—June 25 to July 19.

Principal cause: The grasses, Poaceæ group, the most common being the following: Redtop, *Agrostis palustris;* timothy, *Phleum pratense;* quack grass, *Agropyron repens;* green foxtail, *Chætochloa viridis;* barnyard grass, *Echinochloa crus-galli;* and bluegrass, *Poa pratensis.*

Minor cause: Saltweed, *Atriplex argentea*—Chenopodiaceæ group.

Fall hay fever.—August 14 to September 26.

Principal cause: Common ragweed, *Ambrosia elatior.*

Minor cause: Giant ragweed, *Artemisia trifida,* and western ragweed, *Ambrosia psilostachya—Artemisia* group; Russian thistle, *Salsola pestifer*—Chenopodiaceæ group; and wormwoods, *Artemisia ludoviciana, dracunculoides,* and *caudata—Artemisia* group.

Hay-fever resorts.—Duluth is favorably reported.

MISSISSIPPI.

Spring hay fever.—May 10 to July 10.

Principal cause: The grasses, Poaceæ group, the most common being smut grass, *Sporabolus berteroanus;* Bermuda grass, *Capriola dactylon;* yellow foxtail, *Chætochloa lutescens;* crabgrass, *Syntherisma sanguinalis;* barnyard grass, *Echinochloa crus-galli;* marsh grass, *Panicum repens;* and water grass, *Paspalum dilatatum.*

Minor cause: Curly dock, *Rumex crispus;* spiny amaranth, *Amaranthus spinosus;* English plantain, *Plantago lanceolata;* and lamb's-quarters, *Chenopodium album*—Chenopodiaceæ group.

Locally: Elm, *Ulmus americana;* swamp poplar, *Populus heterophylla;* black willow, *Salix nigra,* and oaks, species of *Quercus.*

Fall hay fever.—August 18 to October 25.

Principal cause: Common and giant ragweed, *Ambrosia elatior* and *trifida.*

Minor cause: Cocklebur, species of *Xanthium* and marsh-elder, *Iva ciliata.*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

MISSOURI.

Spring hay fever.—May 10 to July 26.

Principal cause: The grasses, Poaceæ group, the most common being yellow foxtail, *Chætochloa lutescens;* redtop, *Agrostis palustris;* bluegrass, *Poa pratensis;* chess or cheat, *Bromus secalinus;* wild barley, *Hordeum pusillum;* orchard grass, *Dactylis glomerata;* timothy, *Phleum pratense;* and barnyard grass, *Echinochloa crus-galli.*

Minor cause: Lamb's-quarters, *Chenopodium album,* and saltweed, *Atriplex argentea* and *hastata*—Chenopodiaceæ group.

Locally: Red maple, *Acer rubrum;* white ash, *Fraxinus americana,* and black willow, *Salix nigra.*

Fall hay fever.—August 12 to September 24.

Principal cause: Common and giant ragweed, *Ambrosia elatior* and *trifida.*

Minor cause: Western and lance-leaf ragweed, *Ambrosia psilostachya* and *bidentata*—Ambrosiaceæ group.

Locally: The wormwoods, *Artemisia biennis* and *caudata—Artemisia* group.

Hay-fever resorts.—None reported by the State board of health.

MONTANA.

Spring hay fever.—May 15 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Wheat grass, *Agropyron dasystachyum;* blue grama *Bouteloua gracilis;* Colorado bluestem, *Agropyron smithii;* alkali bunch grass, *Sporobolus airoides;* Hungarian brome grass, *Bromus inermis;* feather bunch grass, *Stipa viridula;* and crabgrass *Syntherisma linearis.*

Fall hay fever.—August 5 to September 15.

Principal cause: Common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group; and common sagebrush, *Artemisia tridentata;* carpet sage, *Artemisia frigida;* and prairie wormwood, *Artemisia ludoviciana—Artemisia* group.

Hay-fever resorts.—None reported.

NEBRASKA.

Spring hay fever.—May 15 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Downy brome grass, *Bromus tectorum;* bluegrass, *Poa pratensis;* Colorado bluestem, *Agropyron smithii;* quack grass, *Agropyron repens;* timothy, *Phleum pratense;* and squirrel-tail, *Hordeum jubatum.*

Locally: Cottonwoods, *Populus sargentii* and *angustifolia.*

Minor cause: Greasewood, *Sarcobatus vermiculatus*—Chenopodiaceæ group.

Fall hay fever.—August 8 to September 18.

Principal cause: In the eastern section of the State the common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group; in the western section the Indian wormwood, *Artemisia dracunculoides;* prairie sage, *Artemisia gnaphalodes,* and Canada wormwood, *Artemisia canadensis*—Artemisia group.

Minor cause: The species of *Franseria, discolor, tomentosa,* and *acanthicarpa*—Ambrosiaceæ group.

Hay-fever resorts.—The high, elevated areas of the western part of the State are of benefit to hay-fever sufferers.

NEVADA.

Spring hay fever.—May 1 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Hungarian brome grass, *Bromus inermis;* feather bunch grass, *Stipa viridula;* dogtown grass, *Aristida longiseta;* sleepy grass, *Stipa vaseyi;* false oat grass, *Trisetum spicatum;* Colorado bluestem, *Agropyron smithii;* bearded wheat grass, *Agropyron caninum.*

Minor cause: Greasewood, *Sarcobatus vermiculatus*—Chenopodiaceæ group.

Fall hay fever.—August 12 to September 15.

Principal cause: Indian wormwood, *Artemisia dracunculoides;* California mugwort, *Artemisia heterophylla,* and sagebrush, *Artemisia tridentata—Artemisia* group.

Minor cause: Poverty weed, *Iva axillaris;* prairie ragweed, *Iva xanthiifolia;* bush sandbur, *Franseria dumosa,* and bur ragweed, *Franseria acanthicarpa.*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

NEW HAMPSHIRE.

Spring hay fever.—June 10 to July 16.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Witch grass, *Panicum* species; redtop, *Agrostis palustris;* timothy, *Phleum pratense;* quack grass, *Agropyron repens;*

little bluestem, *Andropogon scoparius;* green foxtail, *Setaria viridis;* and annual bluegrass, *Poa annua.*

Minor cause: Lamb's-quarters, *Chenopodium album;* sheep-sorrel, *Rumex acetosella;* and saltweed, *Atriplex hastata*—Chenopodiaceæ group.

Fall hay fever.—August 16 to October 1.

Principal cause: Common ragweed, *Ambrosia elatior.*

Minor cause: Giant ragweed, *Ambrosia trifida* and cocklebur, *Xanthium* species—Ambrosiaceæ group. Elm, *Ulmus americana,* red ash, *Fraxinus pennsylvanica,* and oaks, species of *Quercus.*

Hay-fever resorts.—None reported.

NEW JERSEY.

Spring hay fever.—June 10 to July 24.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Little bluestem, *Andropogon scoparius;* beard grass, *Paspalum setaceum;* witch grass, *Panicum capillare* and *dichotomiflorum;* barnyard grass, *Echinochloa crus-galli;* yellow foxtail, *Chætochloa lutescens;* nimble Will, *Muhlenbergia schreberi;* purpletop, *Tridens flavus.*

Minor cause: Curly dock and sheep-sorrel, *Rumex crispus* and *acetosella;* lamb's-quarters, *Chenopodium album;* pigweed, *Amaranthus retroflexus;* and English plantain, *Plantago lanceolata*—Chenopodiaceæ group.

Locally, aspen, *Populus tremuloides;* black willow, *Salix nigra;* and oaks, species of *Quercus.*

Fall hay fever.—August 17 to September 28.

Principal cause: Common and giant ragweeds, *Ambrosia elatior* and *trifida,* and cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Minor cause: Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—Partial relief at locations along the Atlantic coast and Beach Haven in Ocean County.

NEW MEXICO.

Spring hay fever.—May 3 to June 5.

Principal cause: The grasses, Poaceæ group, the most common being, Hungarian brome grass, *Bromus inermis;* feather bunchgrass, *Stipa viridula;* dogtown grass, *Aristida longiseta;* sleepy grass, *Stipa vaseyi;* false oat grass, *Trisetum spicatum;* Colorado bluestem, *Agropyron smithii;* bearded wheat grass, *Agropyron caninum.*

Minor cause: Greasewood, *Sarcobatus vermiculatus*—Chenopodiaceæ group.

Locally: Cottonwood, *Populus wislizeni.*

Fall hay fever.—July 12 to September 28.

Principal cause: Sagebrush, *Artemisia tridentata;* carpet sage, *Artemisia frigida,* and other wormwoods—*Artemisia* group.

Minor cause: Poverty weed, *Iva axillaris;* bur ragweed, *Franseria acanthicarpa* and *Franseria tenuifolia*—Ambrosiaceæ group.

Hay-fever resorts.—Cloudcroft, Whitcom Springs, Albuquerque, Valley Rancho, Glorietta, Jemez Springs, Sulphur Springs, El Porvenir, and East Las Vegas.

NEW YORK.

Spring hay fever.—June 5 to July 19.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Little bluestem, *Andropogon scoparius;* witch or panic grass, *Panicum;* barnyard grass, *Echinochloa crus-galli;* foxtail, *Chætochloa glauca* and *viridis;* reed canary grass, *Phalaris arundinacea;* quack grass, *Agropyron repens;* dropseed grass, *Muhlenbergia;* redtop, *Agrostis palustris;* blue-joint, *Calamagrostis canadensis;* wild oat-grass, *Danthonia spicata;* love grass, *Eragrostis;* orchard grass, *Dactylis glomerata;* annual bluegrass, *Poa annua;* manna grass, *Panicularia nervata.*

Minor cause: Curly dock, *Rumex crispus;* pigweed, *Amaranthus retroflexus* and *hybridus;* Jerusalem oak and lamb's-quarters, *Chenopodium botrys* and *album*—Chenopodiaceæ group.

Fall hay fever.—August 16 to September 28.

Principal cause: Common and giant ragweed, *Ambrosia elatior* and *trifida.*

Minor cause: Cocklebur, species of *Xanthium*—Ambrosiaceæ group; Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Locally: The wormwoods, the most common being *Artemisia biennis* and *stelleriana—Artemisia* group.

Hay-fever resorts.—The Adirondacks, Fire Island, Thousand Islands Park, Big Moose, and Old Forge Lake.

NORTH CAROLINA.

Spring hay fever.—May 13 to June 29.

Principal cause: The grasses, Poaceæ group, the most common being bluegrass, *Poa pratensis;* orchard grass, *Dactylis glomerata;* timothy, *Phleum pratense;* redtop, *Agrostis palustris;* Bermuda grass, *Capriola dactylon;* crabgrass, *Syntherisma sanguinalis;* crowfoot grass, *Dactyloctenium aegyptium;* and witch grass, *Panicum capillare.*

Locally: Elm, *Ulmus americana;* cottonwood, *Populus deltoides;* black willow, *Salix nigra;* and oaks, species of *Quercus.*

Fall hay fever.—August 20 to October 5.

Principal cause: The common and giant ragweeds, *Ambrosia elatior* and *trifida,* the latter being uncommon in the northwest (mountain) section—Ambrosiaceæ group.

Minor cause: Cocklebur, species of *Xanthium*, and marsh-elder, *Iva ciliata*—Ambrosiaceæ group.

Hay-fever resorts.—Eagle's Nest, Glen Ayre, Blackstock Knob, Black Dome, Mount Gibbs, Hall Back, and Mount Mitchell, in the Black Mountains; Double Springs, Richland Balsam, and Jones Knob, in the Balsam Range; Mount Buckley, Clingman's Drive, Mount Love, and Alexander, in the Smoky Mountains.

NORTH DAKOTA.

Spring hay fever.—May 20 to July 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Quack grass, *Agropyron repens;* squirrel tail, *Hordeum jubatum;* millet, *Chætochloa italica;* Hungarian brome grass, *Bromus inermis;* Colorado bluestem, *Agropyron smithii;* wild oats, *Avena fatua;* barnyard grass, *Echinochloa crus-galli;* green foxtail, *Chætochloa viridis;* bluegrass, *Poa pratensis* and *flava.*

Minor cause: White dock, *Rumex mexicanus;* pigweed, *Amaranthus retroflexus,* and lamb's-quarters, *Chenopodium album*—Chenopodiaceae group.

Locally: Sargent cottonwood, *Populus sargentii.*

Fall hay fever.—August 10 to September 15.

Principal cause: Common, giant, and western ragweed, *Ambrosia elatior, trifida,* and *psilostachya*—Ambrosiaceae group; carpet sage, *Artemisia frigida;* prairie wormwood, *Artemisia ludoviciana;* and green wormwood, *Artemisia biennis—Artemisa* group.

Hay-fever resorts.—The State board of health reports hay-fever patients benefited at Devils Lake.

OHIO.

Spring hay fever.—May 28 to July 13.

Principal cause: The grasses, Poaceæ group, the most common being, crabgrass, *Syntherisma sanguinalis;* witch grass, *Panicum capillare;* spreading witch grass, *Panicum dichotomiflorum;* barnyard grass, *Echinochloa crus-galli;* green foxtail, *Chætochloa viridis;* love grass, *Eragrostis cilianensis.*

Minor cause: Pigweed, *Amaranthus hybridus* and *retroflexus,* and waterhemp, *Acnida tuberculata.*

Locally: Black willow, *Salix nigra,* and swamp poplar, *Populus heterophylla.*

Fall hay fever.—August 13 to September 20.

Principal cause, common and giant ragweed (horseweed), *Ambrosia elatior* and *trifida*—Ambrosiaceæ group.

Minor cause: The southernwood, *Artemisia abrotanum,* and common wormwood, *Artemisia vulgaris—Artemisia* group; Russian thistle, *Salsola pestifer,* and Jerusalem oak and lamb's-quarters *Chenopodium botrys* and *album*—Chenopodiaceæ group.

Hay-fever resorts.—The State board of health reports no hay-fever resorts known in State.

OKLAHOMA.

Spring hay fever.—May 10 to June 24.

Common cause: The grasses, Poaceæ group, the most common being chess, *Bromus secalinus;* yellow foxtail, *Chætochloa lutescens;* redtop, *Agrostis palustris;* crabgrass, *Chætochloa glauca;* feather bunch grass, *Stipa viridula;* and needle-and-thread grass, *Stipa comata.*

Minor cause: Saltweed, *Atriplex hastata*—Chenopodiaceæ group.

Fall hay fever.—July 25 to October 1.

Principal cause: The giant and common ragweeds, *Ambrosia trifida* and *elatior,* the latter being less common—Ambrosiaceæ group; and the prairie wormwood, *Artemisia ludoviciana—Artemisia* group.

Minor cause: The cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—The State board of health reports that, while hay fever is less common in Oklahoma than in most sections of the country, there is no locality that is absolutely free from this disease.

OREGON.

Spring hay fever.—April 25 to May 29.

Principal cause: The grasses, Poaceæ group. Velvet grass, *Notholcus lanatus* is the most common in western Oregon. Others are, sweet vernal grass, *Anthoxanthum odoratum;* western brome grass, *Bromus carinatus;* orchard grass, *Dactylis glomerata;* rye grass, *Lolium perenne,* and bluegrass, *Poa pratensis.*

Minor cause: The docks, *Rumex crispus* and *occidentalis;* lamb's-quarters and red blite, *Chenopodium album* and *rubrum*—Chenopodicaeæ group.

Fall hay fever.—July 1 to September 10.

Principal cause: Sagebrush, *Artemisia tridentata;* prairie wormwood, *Artemisia ludoviciana.*

Minor cause: Carpet sage, *Artemisia frigida,* and Indian wormwood, *Artemisia dracunculoides—Artemisia* group; poverty weed, *Iva axillaris,* prairie ragweed, *Iva xanthiifolia,* and bur ragweed, *Franseria acanthicarpa*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

PENNSYLVANIA.

Spring hay fever.—June 3 to July 24.

Principal cause: The grasses, Poaceæ group, the following being the most common: Timothy, *Phleum pratense;* redtop, *Agrostis palustris;* bluegrass, *Poa pratensis;* quack grass, *Agropyron repens;* orchard grass, *Dactylis glomerata;* witch grass, *Panicum capillare;* yellow foxtail, *Chætochloa lutescens.*

Locally: Elms, *Ulmus americana* and *alata;* white ash, *Fraxinus americana;* and oaks, species of *Quercus.*

Fall hay fever.—August 16 to September 27.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida,* the latter occurring in great thickets along the flood plains of the rivers, and even on the slopes and upland in great numbers—Ambrosiaceæ group.

Minor cause: Russian thistle, *Salsola pestifer,* and Jerusalem oak and lamb's quarters, *Chenopodium botrys* and *album*—Chenopodiaceæ group.

Hay-fever resorts.—Eaglesmere, the Pocono Mountains, the hills in the vicinity of Bradford, and the mountains near Mont Alto and Caledonia.

RHODE ISLAND.

Spring hay fever.—June 8 to July 22.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Redtop, *Agrostis palustris;* timothy, *Phleum pratense;* orchard grass, *Dactylis glomerata;* bluegrass, *Poa pratensis.* The most common grasses in old fields are sweet vernal grass, *Anthoxanthum odoratum.*

Locally: Aspen, *Populus tremuloides;* black willow, *Salix nigra;* and oaks, species of *Quercus.*

Fall hay fever.—August 15 to September 26.

Principal cause: The common ragweed, *Ambrosia elatior*—Ambrosiaceæ group.

Minor cause: Giant ragweed, *Ambrosia trifida;* marsh-elder, *Iva ciliata;* and cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—The State board of health reports that, while hay fever is not very prevalent, there is no part of Rhode Island free from hay fever.

SOUTH CAROLINA.

Spring hay fever.—May 10 to July 5.

Principal cause: The grasses, Poaceæ group, the following being the most common: Crabgrass, *Syntherisma sanguinalis;* Johnson grass, *Holcus halepensis;* yellow foxtail, *Chætochloa lutescens;* Bermuda grass, *Capriola dactylon;* redtop, *Agrostis palustris;* goose grass, *Eleusine indica;* and water grass, *Paspalum dilatatum.*

Minor cause: Lamb's-quarters, *Chenopodium album;* curly dock, *Rumex crispus;* spiny amaranth, *Amaranthus spinosus;* and plantain, *Plantago major*—Chenopodiaceæ group.

Locally: Elm, *Ulmus americana;* red maple, *Acer rubrum;* swamp poplar, *Populus heterophylla;* and oaks, species of *Quercus.*

Fall hay fever.—August 18 to October 10.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group.

Minor cause: Cocklebur, species of *Xanthium;* horseweed, *Erigeron canadensis;* and marsh-elder, *Iva imbricata*—Ambrosiaceæ group.

Hay-fever resorts.—Caesar's Head, Greenville County.

SOUTH DAKOTA.

Spring hay fever.—May 13 to July 10.

Common cause: The grasses, Poaceæ group, the most common being blue grama, *Bouteloua gracilis;* wheat grass, *Agropyron dasystachyum;* green foxtail, *Chætochloa viridis;* squirrel-tail, *Hordeum jubatum;* crabgrass, *Syntherisma linearis;* bluegrass, *Poa pratensis;* bluejoint, *Andropogon furcatus;* and porcupine grass, *Stipa spartea.*

Locally: Narrow leaf cottonwood, *Populus angustifolia.*

Fall hay fever.—August 8 to September 22.

Principal cause: Prairie wormwood, *Artemisia ludoviciana;* green wormwood, *Artemisia biennis;* and Canada wormwood, *Artemisia canadensis*—*Artemisia* group. These are more common in the country. In the cities the principal causes are the common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group.

Minor cause: Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—Hot Springs.

TENNESSEE.

Spring hay fever.—June 5 to July 22.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Crabgrass, *Syntherisma sanguinalis;* broom sedge *Andropogon virginicus;* redtop, *Agrostis palustris;* barnyard grass, *Echinochloa crus-galli;* yellow foxtail, *Chætochloa lutescens;* goose grass, *Eleusine indica;* purpletop, *Tridens flavus;* bluegrass, *Poa pratensis.*

Locally: Elms, *Ulmus americana* and *alata;* cottonwood, *Populus deltoides;* and oaks, species of *Quercus.*

Fall hay fever.—August 15 to October 5.

Principal cause: The common and giant ragweed, *Ambrosia elatior* and *trifida*—Ambrosiaceæ group. The annual wormwood, *Artemisia annua,* is common in the middle and western sections of the State—*Artemisia* group.

Minor cause: Cocklebur, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—Roan Mountain, altitude 6,310 feet, has long been noted for its relief to hay-fever sufferers.

TEXAS.

Spring hay fever.—May 15 to July 15.

Principal cause: The grasses Poaceæ group, the most common being the following: Yellow foxtail, *Chætochloa lutescens;* Johnson

grass, *Holcus halepensis;* Bermuda grass, *Capriola dactylon;* water grass, *Paspalum larranagai;* smut grass, *Sporobolus berteroanus;* brome grass, *Bromus inermis;* and feather bunchgrass, *Stipa viridula.*

Minor cause: Jerusalem oak and lamb's-quarters, *Chenopodium botrys* and *album*—Chenopodiaceæ group.

Locally: Elm, *Ulmus americana,* narrow leaf cottonwood, *Populus angustifolia,* oaks, species of *Quercus,* and *Juniperus sabinoides,* mountain cedar (Northwestern section).

Fall hay fever.—August 18 to October 15.

Principal cause: In the eastern section, the giant, common, and western ragweed, *Ambrosia trifida, elatior,* and *psilostachya*—Ambrosiaceæ group. In the western portion of the State, the ragweeds are replaced by the wormwoods, the most common being, Indian wormwood, *Artemisia dracunculoides;* carpet sage, *Artemisia frigida;* and prairie wormwood, *Artemisia ludoviciana—Artemisia* group.

Minor cause: Bur ragweed, *Franseria acanthicarpa,* horseweed, *Erigeron canadensis,* and marsh-elder, *Iva ciliata*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

UTAH.

Spring hay fever.—June 22 to July 27.

Principal cause: The grasses, Poaceæ group, the most common being, Hungarian brome grass, *Bromus inermis;* feather bunchgrass, *Stipa viridula;* dogtown grass, *Aristida longiseta;* sleepy grass, *Stipa vaseyi;* false oat grass, *Trisetum spicatum;* Colorado bluestem, *Agropyron smithii;* bearded wheat grass, *Agropyron caninum.*

Minor cause: Greasewood, *Sarcobatus vermiculatus;* saltweed, *Atriplex argentea* and *hastata*—Chenopodiaceæ group; bush sandbur, *Franseria dumosa*—Ambrosiaceæ group.

Fall hay fever.—August 5 to September 15.

Principal cause: Common ragweed, *Ambrosia elatior*—Ambrosiaceæ group; and sage brush and prairie sage, *Artemisia tridentata* and *gnaphalodes—Artemesia* group.

Minor cause: Giant ragweed, *Ambrosia trifida,* and poverty weed, *Iva axillaris*—Ambrosiaceæ group.

Hay-fever resorts.—There are a number of places in various parts of this State, having an altitude of over 6,000 feet, which afford relief to hay-fever subjects; also several canyon resorts, such as Brighton and Ogden, where comparative freedom from hay fever exists. Many persons from Salt Lake City, which has an elevation of 4,300 feet, visit these places and obtain relief.

VERMONT.

Spring hay fever.—June 10 to July 22.

Principal cause: The grasses, Poaceæ group, the following being the most common: yellow foxtail, *Chætochloa lutescens;* barnyard

grass, *Echinochloa crus-galli;* redtop *Agrostis palustris;* little bluestem, *Andropogon scoparius;* timothy, *Phleum pratense;* spreading witch grass, *Panicum dichotomiflorum;* and crab-grass, *Syntherisma sanguinalis.*

Minor cause: Sheep sorrel, *Rumex acetosella;* lamb's-quarters and goosefoot, species of *Chenopodium*—Chenopodiaceæ group.

Locally: White ash, *Fraxinus americana;* red maple, *Acer rubrum;* and oaks, species of *Quercus.*

Fall hay fever.—August 14 to September 24.

Principal cause: The common ragweed, *Ambrosia elatior*—Ambrosiaceæ group.

Minor cause: Giant ragweed, *Ambrosia trifida;* cocklebur, species of *Xanthium*—Ambrosiaceæ group; Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—Green Mountains (4,430 feet).

VIRGINIA.

Spring hay fever.—May 15 to June 29.

Principal cause: The grasses, Poaceæ group, the most common being broom sedge, *Andropogon virginicus;* redtop, *Agrostis palustris;* timothy, *Phleum pratense;* crabgrass, *Syntherisma sanguinalis;* bluegrass, *Poa pratensis;* green foxtail, *Chætochloa viridis;* and barnyard grass, *Echinochloa crus-galli.*

Minor cause: Sheep-sorrel, *Rumex acetosella;* wormseed, *Chenopodium ambrosioides,* and horseweed, *Erigeron canadensis.*

Locally: Black willow, *Salix nigra;* black walnut, *Juglans nigra;* red maple, *Acer rubrum,* and oaks, species of *Quercus.*

Fall hay fever.—August 18 to October 3.

Principal cause: Common ragweed, *Ambrosia elatior.*

Minor cause: Giant ragweed, *Ambrosia trifida,* and marsh-elder, *Iva ciliata*—Ambrosiaceæ group.

Hay-fever resorts.—None reported.

WASHINGTON.

Spring hay fever.—June 12 to July 1.

Principal cause: The grasses, Poaceæ group, the most common being velvet grass, *Nothoholcus lanatus;* early hair-grass, *Aira præcox;* rye grass, *Lolium perenne;* squirrel-tail, *Hordeum jubatum;* chess, *Bromus secalinus,* and other species of *Bromus.*

Fall hay fever.—July 5 to October 7.

Principal cause: The bur ragweeds, *Franseria chamissonis* and *bipinnatifida* (east of Cascade Mountains); poverty weed and prairie ragweed, *Iva axillaris* and *xanthiifolia,* and giant, common, and western ragweed, *Ambrosia trifida, elatior* and *psilostachya*—Ambrosiaceæ group.

Minor cause: Jerusalem oak, *Chenopodium botrys*, and Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—Although there is the usual percentage of hay fever east of the Cascade Range, there is practically none in any part of the State west of this range, which locality is therefore favorable to hay-fever subjects.

WEST VIRGINIA.

Spring hay fever.—May 15 to June 29.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Spreading witch grass, *Panicum dichotomiflorum;* crabgrass, *Syntherisma sanguinalis*; green foxtail, *Chætochloa viridis;* love grass, *Eragrostis cilianensis;* bluegrass, *Poa pratensis;* chess, *Bromus secalinus*, and timothy, *Phleum pratense.*

Minor cause: Curly dock, *Rumex crispus;* Jerusalem oak, *Chenopodium botrys;* and pigweed, *Amaranthus retroflexus*—Chenopodiaceæ group.

Locally: Red maple, *Acer rubrum;* swamp poplar, *Populus heterophylla;* black willow, *Salix nigra;* and oak, species of *Quercus.*

Fall hay fever.—August 12 to September 28.

Principal cause: Common ragweed, *Ambrosia elatior.*

Minor cause: Giant ragweed, *Ambrosia trifida;* the cockleburs, species of *Xanthium*—Ambrosiaceæ group.

Hay-fever resorts.—Terra Alta, Marlinton, and Webster Springs are favorably reported, although their altitude (2,500 feet) is not sufficient to afford marked relief.

WISCONSIN.

Spring hay fever.—June 7 to July 18.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Oats; bluegrass, *Poa pratensis;* timothy, *Phleum pratense;* redtop, *Agrostis palustris;* and quack grass, *Agropyron repens.*

Minor cause: The curly dock, *Rumex crispus*, and lamb's-quarters, *Chenopodium album*—Chenopodiaceæ group.

Locally: Aspen, *Populus tremuloides*, and the oaks, *Quercus alba, velutina, rubra*, and *macrocarpa.*

Fall hay fever.—August 17 to September 28.

Principal cause: Common ragweed, *Ambrosia elatior.*

Minor cause: Giant ragweed, *Ambrosia trifida*, and prairie ragweed, *Iva xanthiifolia* (in western part)—Ambrosiaceæ group; green wormwood, *Artemisia biennis—Artemisia* group; Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—Two Rivers, located on a peninsula extending 7 miles into Lake Michigan.

WYOMING.

Spring hay fever.—May 1 to June 15.

Principal cause: The grasses, Poaceæ group, the most common being as follows: Colorado bluestem, *Agropyron smithii;* alkali, bunchgrass, *Sporobolus airoides;* bluegrass, *Poa pratensis;* timothy, *Phleum pratense;* prairie June grass, *Koeleria cristata;* squirrel-tail, *Hordeum jubatum;* tall manna grass, *Panicularia grandis;* fescue grass, *Festuca elatior;* western wild rye, *Elymus condensatus,* and tufted hair grass, *Deschampsia cæspitosa.*

Fall hay fever.—August 5 to September 15.

Principal cause: Prairie ragweed, *Iva xanthiifolia*—Ambrosiaceæ group; and sagebrush, *Artemisia tridentata*—*Artemisia* group.

Minor cause: Giant and western ragweed, *Ambrosia trifida* and *psilostachya*—Ambrosiaceæ group; northern and aromatic wormwood, *Artemisia borealis* and *aromatica,* and the prairie sage, *Artemisia gnaphalodes*—*Artemisia* group; greasewood, *Sarcobatus vermiculatus,* and Russian thistle, *Salsola pestifer*—Chenopodiaceæ group.

Hay-fever resorts.—The State board of health reports that there is no locality free from hay fever.

QUANTITATIVE STUDIES IN CHEMOTHERAPY.

I. THE TRYPANOCIDAL ACTION OF ARSENIC AND ANTIMONY COMPOUNDS.

By CARL VOEGTLIN, Senior Pharmacologist (R), and HOMER W. SMITH, Assistant Pharmacologist, with the cooperation of MARIAN M. CRANE, Assistant Chemist, and KATHERINE D WRIGHT and MABEL A. CONNELL, Scientific Assistants, Hygienic Laboratory, United States Public Health Service.

The methods used for the elaboration of new drugs with specific action upon the parasites of infectious diseases are essentially empirical in nature. They consist in testing hundreds of chemicals in the hope of finding an effective drug. It is not surprising that under such circumstances progress is retarded principally by an almost complete lack of information regarding the fundamental mechanism by means of which the drug kills the parasite within the host. The present study was undertaken in anticipation of elaborating methods which would yield quantitative information as regards the chemotherapeutic value of certain drugs and which would afford an opportunity of studying the mechanism involved in the process of sterilization of an infected animal. For this purpose no new drugs have been synthetized or studied, but our attention has been confined to a few drugs which are known to possess specific action. We shall report in this paper the principal results obtained in a study of certain antimony and arsenic compounds which are of importance in the treatment of syphilis, relapsing fever, sleeping sickness, and similar protozoal diseases. The details of the work will be published in the Journal of Pharmacology and Experimental Therapeutics during 1920.